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135. Proposed by CHARLES C. CROSS, Whaleyville, Va.

Tangents parallel to the three sides are drawn to the in-circle. If p, q, r, be the lengths of the parts of the tangents within the triangle, prove that

$$\frac{p}{a}+\frac{q}{b}+\frac{r}{c}=1.$$

⁂ Solutions of these problems should be sent to J. M. Colaw not later than June 10.

GEOMETRY.

163. Proposed by J. C. NAGLE, Professor of Civil Engineering in the Agricultural and Mechanical College of Texas, College Station, Texas.

Given the equal sides of an isosceles triangle and the radius of the inscribed circle to solve the triangle. As a numerical example let the known sides be 27 and the radius of the inscribed circle 3.5. The problem occured in connection with some mill work and the exterior angles of the triangle were required in order to make patterns for iron braces.

164. Proposed by J. M. HARCOURT, M. D., 305 Clinton Street, Brooklyn, N. Y.

Given two tangents to a parabola, find the locus of the center of the nine-point circle of the triangle by the two given tangents and any third tangent.

165. Proposed by W. H. ECHOLS, B.Sc., C.E., Professor of Mathematics, University of Virginia, Charlottsville, Va.

$OB=b$, $OA=a$ are the semi-conjugate diameters of an ellipse. Draw BM perpendicular to and equal to OA, cutting it in N. Show that as M slides on the fixed line OM and N on OA the point B traces the curve.

⁂ Solutions of these problems should be sent to B. F. Finkel not later than June 10.

CALCULUS.

128. Proposed by J. SCHEFFER, A. M., Hagerstown, Md.

The differential equation of a curve is $\frac{d^3y}{dx^3}+y=0$. Find its equation, there being the additional conditions that for $x=0$, $y=1$, that the tangent at the point (0, 1) makes an angle of 45° with the axes, and finally that that point is a point of inflexion.

129. Proposed by JOHN M. COLAW, A. M., Monterey, Va.

Among all quadrilaterals inscribed in an ellipse, to determine that which contains the greatest area.

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MECHANICS.

120. Proposed by W. J. GREENSTREET, M. A., Editor of The Mathematical Gazette, Stroud, Gloucestershire, England.

I project an elastic particle along a chord c of a smooth fixed circular rim of diameter d. The coefficient of elasticity between the particle and the rim is e, and the particle continually rebounds. Find the length of the chord described after the nth rebound.

121. Proposed by W. J. GREENSTREET, M. A., Editor of The Mathematical Gazette, Stroud, Gloucestershire, England.

Two equal scale pans of mass m hang at rest over a smooth pulley. An inelastic particle, mass M, is dropped from a height h into one pan, and simultaneously another of equal mass and elasticity e is dropped from the same height into the other. Prove that every impact occurs when the pans are in their original positions, and find the total space described by either pan before motion ceases.

⁂ Solutions of these problems should be sent to B. F. Finkel not later than June 10.

AVERAGE AND PROBABILITY.

104. Proposed by LON C. WALKER, Assistant in Mathematics, Leland Stanford Jr. University, Palo Alto, Cal.

In a given sphere two radii are drawn at random, and a point taken in each at random. (1) Find the chance that the distance between the two points does not exceed the radius of the sphere. (2) Find the distance between them.

105. Proposed by LON C. WALKER, Assistant in Mathematics, Leland Stanford Jr. University, Palo Alto, Cal.

Find the average distance of the center of an ellipsoid, axes $2a$, $2b$, and $2c$, from its surface.

106. Proposed by LON C. WALKER, Assistant in Mathematics, Leland Stanford Jr. University, Palo Alto, Cal.

Required the average distance between two points in a hemisphere.

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MISCELLANEOUS.

105. Proposed by G. B. M. ZERR, A. M., Ph. D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa.

If the refractive index of a medium at any point be $\mu = x$, prove that the path of the ray will be the curve $\frac{2x}{a} = \frac{c}{a} l^{y/a} + \frac{a}{c} l^{-(y/a)}$, a and c being constants.

106. Proposed by J. W. YOUNG, Oliver Graduate Student in Mathematics, Cornell University, Ithaca, N. Y.

Prove that $\frac{(2m)!}{(m!)^2}$ is an integer; and more generally that $\frac{(nm)!}{(m!)^n}$ is an integer, m, n being any positive integers.

107. Proposed by WILLIAM HOOVER, A.M., Ph.D., Professor of Mathematics and Astronomy, Ohio University, Athens, Ohio.

The index of refraction of a medium varying inversely as the square root of the distance, prove that the path of a ray of light in the medium is a cycloid.

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